Breeding success in relation to nestling physiological stress in Prothonotary Warblers at Hoover Reservoir in Delaware County, Ohio

Kira Edic

3/30/17

ABSTRACT

Prothonotary Warblers (*Prothonotaria citrea*) are a neotropical migratory songbird that inhabit wooded swamp areas and have slowly been declining in numbers across their range. Using a population of these birds at Hoover Reservoir in Delaware County, Ohio, we measured the physiological stress levels of nestlings in relation to post-fledging survival and time of year. We collected feathers from recently fledged birds and related corticosterone levels (CORT) to fledge date. We additionally placed radio transmitters on a fledgling from each nest to determine if stress levels are related to post-fledging survival. Using these results, we sought to determine if physiological stress is a mechanism for nestling survival. We interpret results in light of management goals for this Ohio species of conservation concern.

Photos courtesy of Bernadette Rigley.

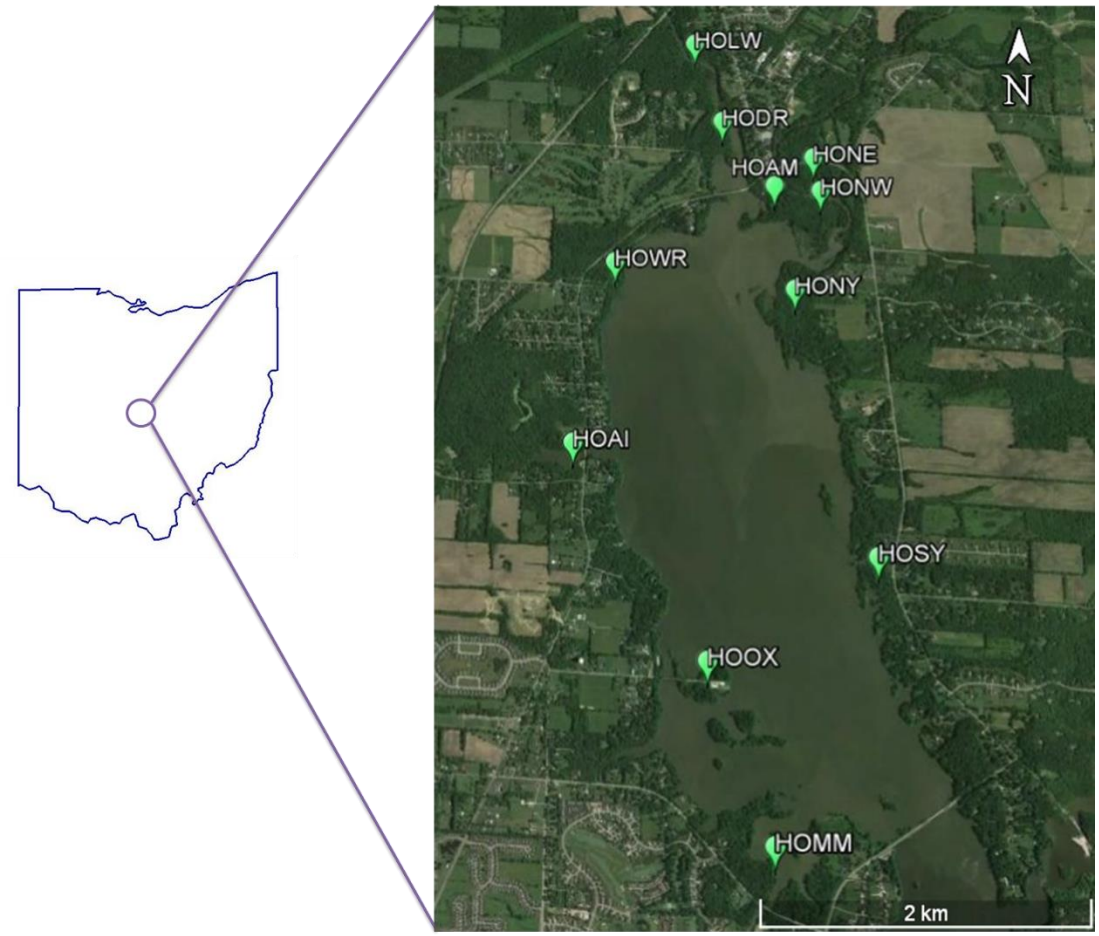
INTRODUCTION

In songbirds, later phenology leads to later breeding success. Physiological stress in young birds could be a mechanism to this relationship due to changes in food and predation risk.[1] CORT levels change in feathers depending on the amount of stress the bird experiences during feather growth, and helps us determine factors that cause stress during the nesting season. Prothonotary Warblers are a migratory species that is a species of concern in Ohio.[2]

- **Hypothesis:** The date that Prothonotary Warblers fledge affects CORT levels, which then affects post-fledging survival.
- **Predictions:** CORT levels will be higher the later in the breeding season a bird fledges, and are negatively related to lower survival.[1]

STUDY AREA

Multiple locations on the northern end of Hoover Reservoir in Delaware County, Ohio. Map pictured below shoes the study sites. Area by reservoir is a bottomland hardwood forest, providing ideal nesting sites for Prothonotary Warblers.



METHODS

During the summer of 2016, we collected feathers from nestlings and placed radio tags on birds. After the breeding season, we extracted CORT from feathers using methanol and determined concentration using an Enzyme Immunoassay (EIA).[3] To compare CORT levels to different variables, we used a linear mixed model with nest as a random effect. We also used a Known Fate Mark-Recapture analysis to calculate survival rate.

RESULTS

SURVIVAL:

100% of all mortalities (50% of all marked individuals) occurred within 7 days of the fledging period. Sampling period (df= 3, X^2= 13.53, p=0.004*). However, CORT was not a predictor of survival (df=1, X^2= 1.86, p= 0.17; Figure 2).

LINEAR MIXED MODEL:

Using the mass, tarsus length, fledge date, and site that each nestling was found at, we only found tarsus length to be significant in relation to CORT (Figure 3).

Mass: df= 1, X^2= 0.0855, p= 0.77

Tarsus: df= 1, X^2= 4.67, p= 0.031*

Fledge date: df= 1, X^2= 0.231, p= 0.63

Site: df= 7, X^2= 7.893, p= 0.34

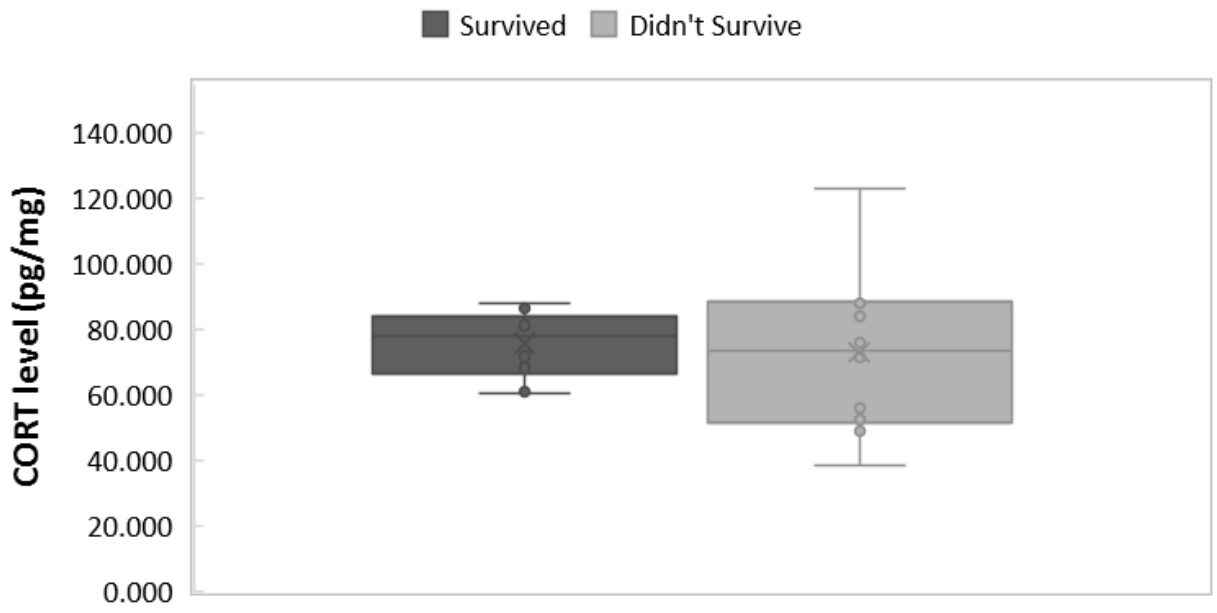


Figure 2. Survival in relation to CORT levels. "X" equals mean. Data collected from Hoover Reservoir, Delaware County, Ohio from April through August, 2016.

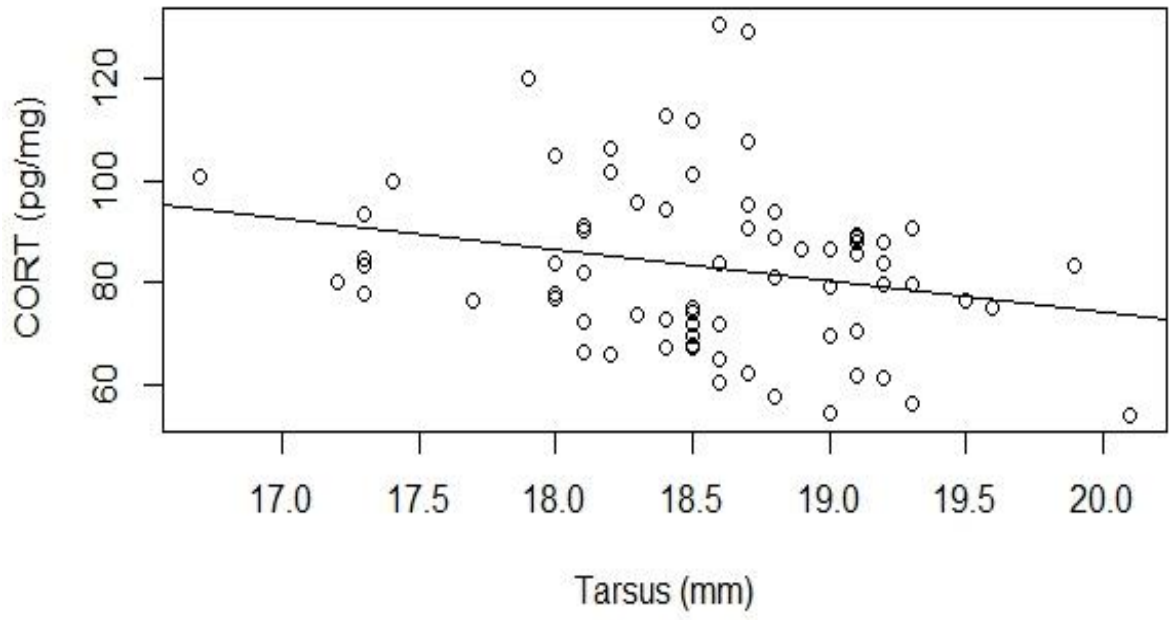


Figure 3. CORT levels in relation to tarsus length. Data collected from Hoover Reservoir, Delaware County, Ohio from April through August, 2016.

DISCUSSION

Higher CORT levels did not appear to affect the post-fledging survival of young Prothonotary Warblers. Also, the date that the nest is established and nestlings fledge does not seem to affect stress levels of young Prothonotary Warblers, suggesting CORT is not a mechanism for the effects of phenology on breeding success. Studies by Holberton et al. (2007) show that having a higher baseline CORT level helps prepare birds for migration by stimulating hunger and foraging. Therefore, it is possible CORT could have similar effects in nestlings by stimulating begging behavior.[4] Our results also indicate that larger birds appear to have less CORT while smaller birds have more CORT. Higher CORT levels in smaller birds encourages them to beg more intensely and may enable smaller birds to compensate for size.

Photo courtesy of Bernadette Rigley.

FUTURE OBJECTIVES

Run further analysis with the linear mixed model using other variables such as, nestling age, sex, or parental age. Different variables might help explain varying CORT levels. Observe feather CORT in nestlings over several breeding seasons and expand sample size to observe different stress factors and trends. If we look at trends over multiple breeding seasons and compare these to environmental variables, it could impact future management of Prothonotary Warblers.

LITERATURE CITED

1. Tonra, C.M., Marra, P.P., and Holberton, R.L. 2011. Migration phenology and winter habitat quality are related to circulating androgen in a long-distance migratory bird. Journal of Avian Biology 42: 397-404.

2. Finch, D.M. and Stangel, P.W. 1992. Status and management of neotropical migratory birds. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Flagstaff, Arizona, U.S.A.

3. Carbajal, A., Tallo-Parra, O., Sabes-Alsina, M., Mular, I., and Lopez-Bejar, M. 2014. Feather corticosterone evaluated by ELISA in broilers: a potential tool to evaluate broiler welfare. Poultry Science 93: 1-3.

4. Holberton, R.L., Boswell, T., and Hunter M.J. 2007. Circulating prolactin and corticosterone concentrations during the development of migratory condition in the Dark-eyed Junco, *Junco hyemalis*. General and Comparative Endocrinology 155: 641–649.

5. Bortolotti, G.R., Marchant, T.A., and German, T. 2008. Corticosterone in feathers is a long-term, integrated measure of avian stress physiology. Functional Ecology 22: 494-500.

ACKNOWLEDGMENTS

Funding partially provided by the Columbus Audubon Society. Thank you also to Bernadette Rigley for providing field work assistance and photographs.